U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: INDUSTRIAL ENGINEERING AND MANAGEMENT **Duration: 3 hrs.**

Course Code: 22IM5PCQAR **Max Marks: 100**

Course: QUALITY ASSURANCE AND RELIABILITY

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Give at least two definitions of Quality. What are the eight dimensions of Quality? Elaborate on how these dimensions determine the Quality of this product taking a case example.	CO1	PO1	**10**
	b)		Clearly bring out the distinction between Traditional Quality methodologies and the Modern approaches to building Quality into the product at the design stage itself. Trace the evolution of the Quality movement and highlight the contribution of the Quality gurus along with their techniques that they have proposed.	CO1	PO1	**10**
			OR			
2	a)		The costs under individual categories are expressed as percentages of the TQC, giving the distribution of the total cost among the four categories. Such a distribution usually reveals information on what is happening within the quality system. The following two examples illustrate the idea: Analyze above the data and give your inference in detail.	CO2	PO1 PO4	**08**
	b)		Explain with a neat sketch Juran's Quality Triology.	CO1	PO1	**08**
	c)		How does Quality Function Deployment as a tool help in managing customer expectations of quality? Give an example to illustrate.	CO1	PO1	**04**

	Example 1	Example 2
Prevention	3%	4%
Appraisal	20%	87%
Internal Failure	9%	9%
External Failure	68%	0%
Total	100%	100%

<table>
<tr><td></td><td></td><td></td><td colspan="2">UNIT - II</td><td></td><td></td><td></td></tr>
<tr><td></td><td>3</td><td>a)</td><td>When drawing samples or subgroups from a process, do you want assignable causes occurring within the subgroups or between them? Give a detailed explanation of the principle of rational subgroup as a concept and its role in the design and operation of control charts.</td><td>CO1</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td></td><td>b)</td><td>If the time order of production has not been recorded in a set of data from a process, is it possible to detect the presence of assignable causes? A manufacturing process produces 500 parts per hour. A sample part is selected about every half hour and after five parts are obtained, the average of these five measurements is plotted on the X control chart. Is this an appropriate sampling scheme if the assignable cause in the process results in the instantaneous upward shift in the mean that is of very short duration? Elaborate clearly.</td><td>CO2</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>What are the main considerations in structuring a quality audit program? List some guidelines for performing quality audit activities.</td><td>CO2</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>What are the fundamental concepts related to Quality audit? Why are Quality audits necessary parts of Quality assurance programs? How will you go about planning and performing the Quality audit activities? Discuss in brief.</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>What does ISO stand for? Discuss the important clauses of ISO 9001 standards. What are the benefits of ISO standards?</td><td>CO2</td><td>PO1
PO4</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>An automobile manufacturer wishes to control the number of nonconformities in a subassembly area producing manual transmissions. The inspection unit is defined as four transmissions, and data from 16 samples (each of size 4) are shown below:
<table>
<tr><th>Sample No.</th><th>No.of nonconformities</th><th>Sample no.</th><th>No. of nonconformities</th></tr>
<tr><td>1</td><td>1</td><td>9</td><td>2</td></tr>
<tr><td>2</td><td>3</td><td>10</td><td>1</td></tr>
<tr><td>3</td><td>2</td><td>11</td><td>0</td></tr>
<tr><td>4</td><td>1</td><td>12</td><td>2</td></tr>
<tr><td>5</td><td>0</td><td>13</td><td>1</td></tr>
<tr><td>6</td><td>2</td><td>14</td><td>1</td></tr>
<tr><td>7</td><td>1</td><td>15</td><td>2</td></tr>
<tr><td>8</td><td>3</td><td>16</td><td>3</td></tr>
</table>
i) Set up a control chart for nonconformities per unit.
ii) Do these data come from a controlled process? If not,</td><td>CO2</td><td>PO1
PO4</td><td>12</td></tr>
</table>

			assume that assignable causes can be found for all out-of-control points and calculate the revised control chart parameters. iii) Suppose the inspection unit is redefined as eight transmissions. Design an appropriate control chart for monitoring future production.			
		b)	Why is the np chart not appropriate with variable sample size? Find the 3-sigma control limits for: i) A C-chart with process average equal to four nonconformities. ii) A U- chart with c=4 and n= 4	CO2	PO1 PO4	**08**
			OR	CO4	PO1 PO4	
	6	a)	Sample of size n=5 are taken from a manufacturing process every hour. A quality characteristic is measured and X and R are computed for each sample. After 25 samples have been analysed, we have $\Sigma X = 662.50$ and $\Sigma R = 9.0$. If the process is in a state of statistical control and normally distributed: i) Find the 3-sigma control limits of X-R charts. ii) Assume that both charts exhibit control. If specifications are 26.40±0.50, estimate the fraction nonconforming. iii) If the mean of the process were 26.40, what fraction nonconforming could result?	CO3	PO2	**12**
		b)	Distinguish between p-chart and np chart.	CO1	PO1	**04**
		c)	Discuss Cu-Sum chart.	CO1	PO1	**04**
			UNIT - IV			
	7	a)	Suppose that a single-sampling plan with n = 150 and c = 2 is being used for receiving inspection where the supplier ships the product in lots of size N = 3000. i) Draw the OC curve for this plan. ii) Draw the AOQ curve and find the AOQL. iii) Draw the ATI curve for this plan.	CO4	PO5 PO9	**12**
		b)	Define the following terms clearly with suitable illustrations i) Average outgoing quality limit. ii) Average sample number. iii) Average total inspection. iv) Lot tolerance percent defective (LTPD).	CO4	PO5 PO9	**08**
			OR	CO4	PO5 PO9	
	8	a)	The lot size is 2000 in a certain AOQL inspection procedure. The desired AOQL of 1% can be obtained with any one of the sampling plans Plan I: n = 36, c=0 Plan II: n = 80, c =1 Plan III: n=140, c=2 Which plan will you select considering both sampling inspection and screening of rejected lots if a large number of lots of 0.5%	CO4	PO5	**12**

			defective are submitted?			
		b)	With a block diagram explain the double sampling plan.	CO1	PO1	**08**
			UNIT - V			
	9	a)	Discuss a few of the common failure models of components. Sketch the Time versus Failure rate and failure density curves, for an exponentially distributed time to failure model. Also sketch the time versus Reliability curve for the exponential failure model.	CO4	PO5 PO9	**08**
		b)	A regulated power supply consists of a step-down transformer, rectifier, filter and a regulator. The constant failure rates of these components are: Transformer 1.56% failures/1000 hours Rectifier 2.00% failures/1000 hours Filter 1 .70% failures/1000 hours Regulator 1 .40% failures/1000 hours Determine the reliability of this supply if it is required to operate for (1) 500 hours (2) 1000 hours (3) 1500 hours. Comment on reliability vs. hours of operation. What is the failure rate of the total supply unit?	CO4	PO5 PO9	**12**
			OR			
	10	a)	Given that a particular component has a constant failure rate and failures follows an exponential destination with λ =0.0005 failures per hour, Determine the reliability of the component for (i) t =10 hours (ii) t = 20 hours (iii) t = 50 hours (iv) t=1000 hours (v) t = 10,000 hours. Plot the time versus reliability graph and draw inferences on the plot that you have obtained.	CO4	PO5 PO9	**12**
		b)	Write the objectives of Life testing.	CO1	PO1	**04**
		c)	Define i) Reliability ii) MTBF	CO1	PO1	**04**

****